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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/883,981	06/20/2001	John W. Andrews	BU9-98-225 DIV	3116
21254	7590	05/10/2004	EXAMINER	
MCGINN & GIBB, PLLC 8321 OLD COURTHOUSE ROAD SUITE 200 VIENNA, VA 22182-3817			BLUM, DAVID S	
			ART UNIT	PAPER NUMBER
			2813	

DATE MAILED: 05/10/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Applicant(s)

09/883,981

Applicant(s)

ANDREWS ET AL.

Examiner

David S Blum

Art Unit

2813

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 23 April 2004.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 8,15,23-32,34-39,41 and 42 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 8,15,23-32,34-39,41 and 42 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892) 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948) 5) ☐ Notice of Informal Patent Application (PTO-152)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ 6) ☐ Other: _____

Art Unit: 2813

This action is in response to RCE and the amendment filed 04/23/04.

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. Claims 8, 15, 23-25, 27, 29-32, 34-36, 38-39 and 41-42 are rejected under 35 U.S.C. 103(a) as being unpatentable over Zheng (US 5,728,621) in view of Liao (US 6,110,795).

Zheng teaches the device of claims 8, 15, 23-25, 27, 29-32, 34-36, 38-39 and 41-42 except for reciting that the trench fill is "seamless" and "substantially scratch free" and co-planar with the substrate. Zheng teaches the device structure of the claims in that a thin oxide layer (12) is grown, (the process mechanism is given no patentable weight in device claims, see product by process discussion below) on the substrate (including the non-trench region) as in claim 34, and wide and narrow shallow trenches (figure 6) are formed on a substrate, and the trenches are filled by a non-conformal high density plasma method (18) and the filler is removed from the pad leaving trench fill in the trench and a planar surface. Figure 7 shows the trench fill and the substrate to be co-planar as in figure 6 of the instant application. As the claims are in the format of device

Art Unit: 2813

(structure) claims, process limitations are given little weight, see product by process discussion below. The filler material is silicon oxide by a high density plasma method (column 3 lines 45-47). It is the high density plasma trench fill method that results in the seamless trench fill (per instant application). It is obvious that as the process steps are like, the results will be the same. Zheng is also silent as to the surface being scratchless, but teaches the trench fill may be either optionally polished or selectively etched (suggested method) to the pad layer (column 3 lines 15-25). Zheng teaches further removal of the trench fill may be optional. Figure 3 shows the high-density plasma oxide fill to be non-conformal as in claims 24 and 38.

Even though product-by-process claims are limited by and defined by the process, determination of Patentability is based upon the product itself. The patentability of a product does not depend on its method of production." MPEP 2113

Regarding the limitation "upper surface of said non-trench region comprising implanted dopants" (claims 8, 15, and 23), this is conventional in trench isolations as the trenches are used to separate/isolate devices such as transistors and transistors have implants/dopants in the substrate surface to form source/drains. Zheng (figure 10 shows this as part #34). Zheng refers to parts 34 as source and drain regions (column 3 line 45) but does not state that the region contains dopants. This is inherent to source and drains, that without a dopant species, they will not function. That the dopants are implanted (product by process limitation) is given no patentable weight as previously discussed. It is not patentable as to the process of placing the dopants (implant,

Art Unit: 2813

diffusion), but that they are present in the structure. Zheng teaches source/drains, thus the dopants are present.

Regarding the limitation "wherein a thickness of said single layer of HDP oxide comprises an as-deposited thickness" (claims 8, 15, and 23), as the HDP layer (fill) of Zheng is deposited, a thickness (any thickness) of the layer comprises an as-deposited thickness.

Regarding the limitation "wherein said as deposited thickness is substantially the same as an originally deposited thickness", as best understood by the examiner, this refers to the deposited thickness being equal to the original thickness of the layer without any polishing or etching that decreases it's thickness. This is accomplished by masking the oxide fill prior to etching. Zheng also masks the oxide fill prior to etching and the fill of figure 10 is substantially the same as the as-deposited fill of figure 8. Zheng (column 3 lines 32-38) teaches that the step height between the active areas and the isolation areas is reduced with some over etch, but the examiner believes this still teaches that the remaining thickness is substantially the same as the deposited thickness. Further, the instant specification teaches that some etch to the layer will occur ("before the photoresist is applied to the wafer surface and patterned, the deposited filler material is etched slightly" page 7 lines 20-21, "an equal amount of films 50a and 50b are likewise removed by the etch process" page 8 lines 4-5, see figures 1 and 2, the resultant thickness of the fill is less than the original as-deposited fill). Thus in light of the

Art Unit: 2813

specification (teaching the resultant thickness of the fill is less than the original as-deposited fill), Zheng is considered to be within “substantially” the same as an originally deposited thickness.

Liao also teaches using selective etching (not reactive ion etching) to avoid micro-scratches caused by polishing, but does not etch down to the substrate level. Thus, Zheng teaches a method which will result in the structure being substantially scratch free and Liao teaches which of the methods will yield the desired result. As defined by the specification, chatter marks are caused by CMP and by Liao teaching away from CMP to avoid micro-scratches, the lack of polishing will also eliminate chatter marks.

The limitation where the surface is planarized “without etch back” or “without reactive ion etching” or “without chemical mechanical polishing” is considered a process limitation on the product and is given no patentable weight. The surface need only be planarized to be of the same structure.

Even though product-by-process claims are limited by and defined by the process, determination of Patentability is based upon the product itself. The patentability of a product does not depend on its method of production.” MPEP 2113

Regarding the limitation “wherein said unpolished upper surface of said HDP oxide has been etched to expose a pad oxide layer formed on said upper surface of said non-trench region, this is also a product by process limitation and given no patentable weight. The structure need only have the pad oxide exposed. Also, as figure 6 shows

Art Unit: 2813

the pad oxide covered by the nitride layer above it and figure 7 shows the pad oxide removed, it is determined that this limitation is toward an intermediate structure. Zheng shows the pad oxide covered by the nitride layer (figure 6) and figure 7 shows the pad oxide removed, as in the instant application. Zheng teaches, the nitride layer is etched away (thus the pad oxide is exposed in an intermediate structure) and the pad oxide is removed (column 3 lines 26-28).

Regarding claim 36, Zheng teaches at least one wide trench and at least one narrow trench (figure 2).

Regarding claim 39, Zheng teaches the device structure of the claims in that a thin oxide layer (12) is grown (the process mechanism is given no patentable weight in device claims) on the substrate (including the non-trench region). This is considered to be a high-purity oxide, the term "high –purity" not being defined in the original claims or specification.

It would be obvious to one skilled in the requisite art at the time of the invention to modify Zheng by choosing a removal method taught by that will result in a substantially scratch free surface as taught by Liao with reasonable expectation of producing a trench fill with a planar surface with reduced surface flaws (Zheng, background, Liao).

Art Unit: 2813

3. Claims 26, 28, and 37 are rejected under 35 U.S.C. 103(a) as being unpatentable over Zheng (US 5,728,621) in view of Liao (US 6,110,795) and in further view of Kunikiyo (US006620703B2).

Zheng and Liao teach the device of claims 26, 28, and 37 as recited above in regard to claims 8, 24, and 23 except for the high-density plasma oxide comprising fluorine-doped high-density plasma oxide.

Kunikiyo teaches filling the isolation trench with a doped oxide, particularly SiOF, fluorine doped silicon oxide (column 10 lines 54-55) as in claims 26 and 28. The dopant improves upon the mismatch in volumetric expansion between the fill and the silicon substrate during subsequent heating steps (column 10 lines 59-67) and reduces leak current (column 11 lines 1-5).

It would be obvious to one skilled in the requisite art at the time of the invention to modify Zheng and Liao by using a (fluorine) doped fill as taught by Kunikiyo to improve upon the mismatch in volumetric expansion between the fill and the silicon substrate during subsequent heating steps (column 10 lines 59-67) and reduces leak current (column 11 lines 1-5).

Response to Arguments

Applicant's arguments filed 4/23/04 have been fully considered but they are not persuasive.

Art Unit: 2813

The applicant argues that all of the claims presently pending in the application are patently distinct over the prior art of record and are in condition for allowance. Based upon the rejections above, the examiner disagrees with the applicant.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to David S. Blum whose telephone number is (757)-272-1687) and e-mail address is David.blum@USPTO.gov .

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Carl Whitehead Jr., can be reached at (571)-272-1702. Our facsimile number all patent correspondence to be entered into an application is (703) 872-9306. The facsimile number for customer service is (703)-872-9317.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



David S. Blum

May 6, 2004